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Cochrane in *CORR*®: Intramedullary Nails for Extracapsular Hip Fractures in Adults (Review)

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Importance of the Topic

More than 1.5 million patients suffer hip fractures worldwide each year [3], and annual direct and indirect costs are projected to exceed USD 130 billion globally by 2050 [6]. Thirty-day mortality approaches 5% in males and 9% in females, and many more patients experience significant functional loss and debilitation [4]. Approximately 50% of all hip fractures are extracapsular, which surgeons can treat using a wide variety of possible internal fixation strategies.

Extramedullary sliding hip screws were the standard of care from the 1950s to the 1990s, but many surgeons now prefer intramedullary nails that interlock proximally in the femoral head [2]. There has been a more than 20-fold relative increase in the utilization of intramedullary nails since 1999, and approximately two-thirds of new orthopaedic surgeons now select them routinely [1]. Several designs are on the market from different manufacturers, each varying in length, diameter, neck-shaft angle, number of locking screws or blades, ability to slide and/or compress, ability to control rotation, construction materials, start-point, and surgical technique. This review aimed to determine whether different nail designs are associated with unique benefits or harms in patients with extracapsular hip fractures. Twelve designs were evaluated among 2130 patients from 17 separate trials. The authors concluded that there were no important differences in function, mobility, pain, death, fracture fixation complications, or rates of revision surgery between most of the implants that were studied.

A Note from the Editor-In-Chief: We are pleased to publish the next installment of Cochrane in CORR®, our partnership between CORR®, The Cochrane Collaboration®, and McMaster University's Evidence-Based Orthopaedics Group. In it, researchers from McMaster University will provide expert perspective on an abstract originally published in The Cochrane Library that we think is especially important.

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Cochrane Reviews are regularly updated as new evidence emerges and in response to feedback, and The Cochrane Library (http://www.thecochranelibrary.com) should be consulted for the most recent version of the review.

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Upon Closer Inspection

Extracapsular hip fractures include pertrochanteric simple fractures (AO classification 31-A1), pertrochanteric multifragmentary fractures (31-A2), intertrochanteric fractures (31-A3), and subtrochanteric fractures (32-A/B/C [1–3].1). Reverse obliquity intertrochanteric fractures, intertrochanteric fractures with subtrochanteric extension, and subtrochanteric fractures each carry a worse prognosis than A1 or A2 fractures [7, 8], and unequal inclusion of patients with these fractures in the primary trials could bias the pooled results towards worse outcomes for the treatment group that has more of them. In order to avoid this problem, the authors attempted to separate the results for patients with subtrochanteric fractures from the results for patients with intertrochanteric and pertrochanteric fractures. These types of secondary analyses are commonly referred to as a subgroup analyses and they are frequently used to address specific questions about particular patient groups, types of intervention, or types of study designs.

There are two important ways that subgroup analyses can be problematic. First, subgroup analyses are rarely powered adequately, which leaves them at risk of failing to identify important differences between treatment groups (Type II error). Second, testing multiple subgroups raises the possibility of identifying spurious but statistically significant differences due to chance alone, simply because there have been more "rolls of the dice" (Type I error) [11]. Readers can distinguish credible from less-credible subgroup claims by looking for hypotheses that were formulated before collecting the data, are supported by background literature and/or biological rationale, and are consistent across studies. The direction of a potential subgroup effect should be also prespecified and only a small number of carefully considered hypotheses should be considered. The proposed subgroup for subtrochanteric fractures met many of these criteria, but there was insufficient data in the primary trials to test it. As such, this meta-analysis does not inform whether certain nails might be better suited to specific fractures [9].

Take-Home Messages

Overall confidence in the pooled results was addressed using the Grades of Recommendation, Assessment, Development and Evaluation (GRADE) approach [5]. Confidence ratings are important because they reflect variations in the design of the primary studies, the risk of bias within and across the primary studies, the degree of imprecision in the pooled results, inconsistency, and indirectness. The GRADE approach has been adopted by more than 70 major health research organizations because it is transparent, structured, and comprehensive enough to guide treatment recommendations. The quality of the evidence for most comparisons in this meta-analysis was low or very low, which indicates that our confidence in the pooled effect estimates is actually limited and that the pooled estimates might differ substantially from reality. In comparison to sliding hip screws, the potential advantages of nailing include a shorter and more rigid moment arm and the contention that insertion is less invasive. However, nails cost between USD 700 and USD 1700 more per implant than sliding hip screws [12] and patient-important functional outcomes across most fracture patterns are similar in the current literature [10]. A recent economic evaluation found that intramedullary nail fixation was routinely cost-effective only for A3 fractures while sliding hip screw fixation was favored for all A1 fractures and most A2 fractures [12], but these conclusions were highly sensitive to the fixation failure rates. Given that older nails were associated with more reoperations and intra and postoperative fractures, and that modern nails and increased clinical experience may have solved these issues [2], further research

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comparing modern nails against sliding hip screws is likely to be of substantial value. At least one adequately powered multicenter randomized trial is currently registered and underway (NCT01380444), but additional trials and other study designs will also be needed to evaluate varying fracture patterns across different patient populations.

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Appendix

Intramedullary nails for extracapsular hip fractures in adults (Review)

Queally JM, Harris E, Handoll HHG, Parker MJ

This is a reprint of a Cochrane review, prepared and maintained by The Cochrane Collaboration and published in *The Cochrane Library* 2014, Issue 9

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[Intervention Review]

Intramedullary nails for extracapsular hip fractures in adults

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ABSTRACT

Background

Intramedullary nails may be used for the surgical fixation of extracapsular hip fractures in adults. This is an update of a Cochrane review first published in 2005 and last updated in 2008.

Objectives

To assess the effects (benefits and harms) of different designs of intramedullary nails for treating extracapsular hip fractures in adults.

Search methods

We searched the Cochrane Bone, Joint and Muscle Trauma Group Specialised Register (6 January 2014), the Cochrane Central Register of Controlled Trials (*The Cochrane Library* Issue 12, 2013), MEDLINE (1966 to November Week 3, 2013), MEDLINE In-Process & Other Non-Indexed Citations (3 January 2014), EMBASE (1988 to 2014, Week 1) and the World Health Organization (WHO) International Clinical Trials Registry Platform (accessed January 2014).

Selection criteria

All randomised or quasi-randomised trials comparing different types, or design modifications, of intramedullary nails in the treatment of extracapsular hip fractures in adults.

Data collection and analysis

At least two review authors independently selected studies, assessed risk of bias and extracted data. We performed limited meta-analysis using the fixed-effect model.

Main results

We included eight new trials, testing seven new comparisons in this update. Overall, we included 17 trials, testing 12 comparisons of different cephalocondylic nail designs. The trials involved a total of 2130 adults (predominantly female and older people) with mainly unstable trochanteric fractures.

All trials were at unclear risk of bias for most domains, with the majority at high risk of detection bias for subjective outcomes. The three quasi-randomised trials were at high risk for selection bias.

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Four trials (910 participants) compared the proximal femoral nail (PFN) with the Gamma nail. There was no significant difference between the two implants in functional outcome (the very low quality evidence being limited to results from single trials), mortality (low quality evidence: 86/415 versus 80/415; risk ratio (RR) 1.08, 95% confidence interval (CI) 0.82 to 1.41), serious fixation complications (operative fracture of the femur, cut-out, non-union and later fracture of the femur) nor re-operations (low quality evidence: 45/455 versus 36/455; RR 1.25, 95% CI 0.83 to 1.90).

Two trials (185 participants) provided very low quality evidence of a lack of clinically significant difference in outcome (functional score, mortality, fracture fixation complications and re-operation) between the ACE trochanteric nail and the Gamma nail.

Two trials (200 participants) provided very low quality evidence of a lack of significant difference in outcome (mobility score, pain, fracture fixation complications or re-operations) between the proximal femoral nail antirotation (PFNA) nail and the Gamma 3 nail.

Seven of the nine trials evaluating different comparisons provided very low quality evidence of a lack of significant between-group differences in all of the reported main outcomes for the following comparisons: ACE trochanteric nail versus Gamma 3 nail (112 participants); gliding nail versus Gamma nail (80 participants); Russell-Taylor Recon nail versus long Gamma nail (34 participants, all under 50 years); proximal femoral nail antirotation (PFNA) nail versus Targon PF nail (80 participants); dynamically versus statically locked intramedullary hip screw (IMHS) nail (81 participants); sliding versus non-sliding Gamma 3 nail (80 participants, all under 60 years); and long versus standard PFNA nails (40 participants with reverse oblique fractures).

The other two single comparison trials also provided very low quality evidence of a lack of significant between-group differences in all of the main outcomes with single exceptions. The trial (215 participants) comparing the ENDOVIS nail versus the IMHS nail found low quality evidence of poorer mobility in the ENDOVIS nail group, where more participants in this group were bedridden after their operation (29/105 versus 18/110; RR 1.69, 95% CI 1.00 to 2.85; P = 0.05). The trial (113 participants) comparing the InterTan nail versus the PFNA II nail found very low quality evidence that more PFNA II group participants experienced thigh pain (3/47 versus 12/46; RR: 0.24, 95% CI 0.07 to 0.81).

Authors' conclusions

The limited evidence from the randomised trials undertaken to date is insufficient to determine whether there are important differences in outcome between different designs of intramedullary nails used in treating extracapsular hip fractures. Given the evidence of superiority of the sliding hip screw compared with intramedullary nails for extracapsular hip fractures, further studies comparing different designs of intramedullary nails are not a priority. Any new design should be evaluated in a randomised comparison with the sliding hip screw.

PLAIN LANGUAGE SUMMARY

Intramedullary nails for extracapsular hip fractures in adults

What is the medical problem?

Fractures of the upper part of the thigh bone (femur) are termed hip or proximal femoral fractures. These fractures are most common in women aged over 65 years. Roughly two out of five hip fractures are 'extracapsular' in that they lie outside the hip joint capsule.

What treatments are available?

The majority of these fractures are fixed surgically using metal implants. One increasingly used implant is the 'intramedullary nail'. This consists of a metal rod, which is usually inserted from the upper end of the femur into the inner cavity (medulla) of the femur bone and held in place with screws. There are several different types of nails, usually made by different manufacturers, in use.

Are some intramedullary nails better than others for these fractures?

This review set out to examine the evidence from trials that compared different designs of nails in clinical practice.

We searched medical databases and registers of new studies (until January 2014) and found 17 trials that compared different nail designs. These involved a total of 2130 participants. Most participants were older women.

The quality of the evidence from these trials is low or very low, partly because most trials used flawed methods that mean their results may not be reliable. In addition, several trials did not report on function or provide data that could be used. Of the 12 different comparisons tested, nine were tested by one trial only.

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Four trials compared the proximal femoral nail (PFN) with the Gamma nail in 910 older adults. Two trials compared the ACE intramedullary nail with the Gamma nail in 185 older adults. Two trials compared the proximal femoral nail antirotation (PFNA) with the Gamma 3 nail in 200 older adults. The other nine trials were single comparisons of different types of nail designs.

Overall, the weak evidence available for all 12 comparisons showed no important differences in outcome (function, mobility, pain, death, fracture fixation complications and revision surgery) between the two nails or two nail designs under test. There was one possible exception. There was weak evidence from one trial of 215 older adults that the ENDOVIS nail resulted in poorer mobility (more people could not walk after their operation) when compared with the intramedullary hip screw (IMHS). However, more evidence is required to be confident of this result.

In conclusion, the available evidence is insufficient to determine whether there are important differences in outcome between different designs of intramedullary nails used for fixing extracapsular hip fractures. In terms of future research, we propose that priority is given to comparisons of intramedullary nails with another type of device in common use, the sliding hip screw.

Intramedullary nails for extracapsular hip fractures in adults (Review)

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